A STUDY OF THE UNCOORDINATED CARBOXYL GROUPS IN GLUTAMIC ACID COMPLEXES

by

PHILIP ARCHIBALD HORRIGAN
B. S., Massachusetts Institute of Technology, 1948
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AN ABSTRACT OF A THESIS

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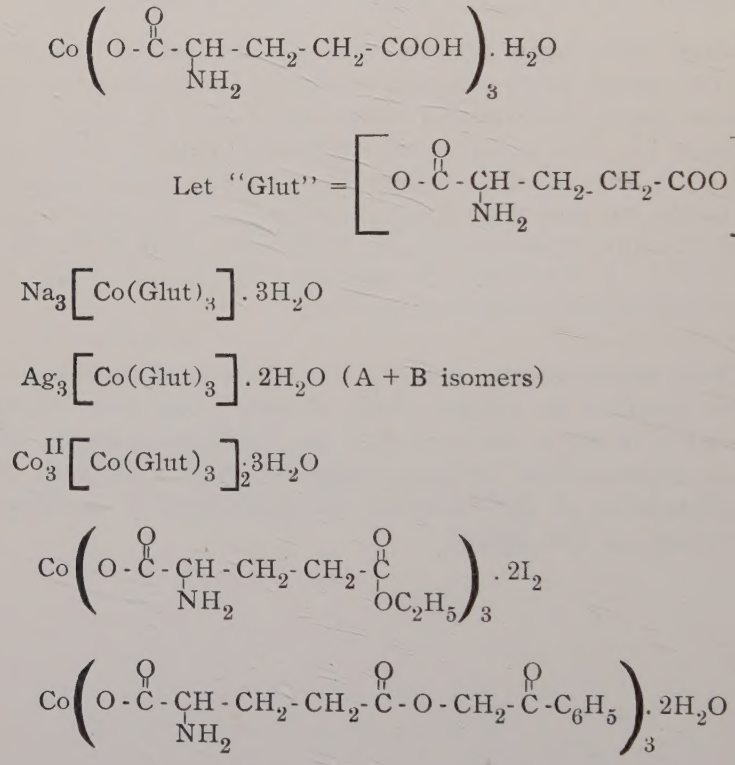
There have been reports that uncoordinated functional groups on ligands react one way when the ligand is coordinated to a metal atom, and another when the ligand is "free". V. I. Kuznetsov (1) has stated that o-phenanthroline, when complexed with ferrous ion, couples energetically with diazonium sulphanilate or p-nitroaniline-o-sulphanilate, whereas o-phenanthroline alone does not couple with diazonium salts. R. N. Keller and L. J. Edwards (2) report a complex of cobalt (III) with N-hydroxyethyl-ethylenediamine.

These investigators, making the obvious assumption that the coordination is taking place through the two nitrogen atoms, tried to form derivatives of the hydroxy groups. However, no characteristic hydroxy reactions were observed. The unusual stability of this complex was attributed to an effect of coordination on the ligand.

To obtain more evidence with respect to these reported "effects of coordination on the coordinating group," complexes of cobalt and copper with glutamic acid were prepared, and the chemical and physical properties of the uncoordinated carboxyl groups were studied. The following is a list of the compounds prepared:



$$Na_2\left[Cu(Glut)_2\right].3H_2O$$

$$Cu\left[Cu(Glut)_2\right].H_2O$$

$$Cu\left(O\text{-}\overset{O}{\overset{\|}{C}}\text{-}\underset{NH_2}{CH}\text{-}CH_2\text{-}CH_2\text{-}\overset{O}{\overset{\|}{C}}\text{-}O\text{-}CH_2\text{-}\overset{O}{\overset{\|}{C}}\text{-}C_6H_4\text{-}Br\right)_2.H_2O$$

All the above salts and esters were prepared after the glutamic acid had been coordinated to the metal atom, thus illustrating that the uncoordinated carboxyl groups react as would be expected. The infra-red and visible spectra of most of these complexes were prepared. It is interesting to note that the tris (—L-*w*-ethyl glutamato) cobaltate (III) 2 iodine is a complex that dissolves in organic solvents to give a yellow-green solution.

This work has demonstrated that the uncoordinated carboxyl groups in cobalt and copper glutamate complexes exhibit no anomalous properties. It may therefore be stated that there is no apparent "effect of coordination on the coordinating group" with this type of complex.

These results are in agreement with those of A. C. Kurtz (3, 4) who prepared many amino derivatives of copper complexes containing uncoordinated amino groups.

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VITA

Philip Archibald Horrigan was born on October 8, 1928, in Brighton, Massachusetts. After graduating from Boston Latin School in 1945, he entered the Massachusetts Institute of Technology, where he received the degree of Bachelor of Science in June, 1948. He then entered the Graduate School of Boston College and received the degree of Master of Science in June, 1950. During the next year he was employed by the research department of the Lever Brothers Company in Cambridge, Massachusetts. In September, 1951, he entered the Graduate College of the University of Illinois.